physiology of the carotenoids, much effort has been expended in developing methods whereby the components of naturally occurring carotene mixtures may be separated and recovered in crystalline form.

The experience in this laboratory indicates that carotenes are most easily separated by passing a solution of the mixture over columns composed of suitable adsorbents (Tswett column). Under these conditions α-carotene moves through the column faster than the other carotenes associated with it. The β-carotene in turn moves faster than the remaining carotenes and lycopene, which are held most strongly by the adsorbent at the top of the column. By separating the column and eluting the pigments from each portion, the individual carotenes may be obtained in crystalline form.

It has also been found that α-carotene may be separated from carotene mixtures by passing solutions of the latter over columns containing slightly less than enough adsorbent to retain all the carotene with the result that α-carotene accumulates in the filtrate. After removing the top portion of the adsorbent, the β-carotene can be eluted from the bulk of the adsorbent without removing the latter from the column.

Of the numerous adsorbents tested for the separation of carotenes, magnesium oxide possesses the greatest number of desirable properties. This oxide is white, so that the positions of the adsorbed constituents are readily visible. Unlike some of the heavy metal oxides magnesium oxide does not affect the carotene through oxidation. It exhibits a highly specific adsorption for each carotene. Magnesium oxide is readily obtained in a high state of purity and in an extremely active form so that only small amounts of adsorbent (0.1–0.3 gm per mgm carotene) are required, thus effecting an economy in solvent (petroleum ether) and in time. In this respect magnesium oxide is a better adsorbent than the samples of calcium oxide and hydroxide which have been used in this laboratory and which have been recommended as adsorbents for carotene by other workers. Moreover, the adsorbed carotenes may be removed by eluting with petroleum ether containing ethanol, which is not the case with charcoal and fuller's earth. After eluting the carotene, the magnesium oxide can be recovered by drying in an oven at 110–150°. It should be pointed out that the adsorptive powers of magnesium oxide are largely dependent on its method of preparation. Most of the magnesium oxide preparations used in the separation of carotenes were manufactured by the low-temperature decomposition of magnesium hydroxide and were supplied to us through the courtesy of Mr. Max Y. Seaton, of the California Chemical Corporation, Newark, Calif. By mixing the magnesium oxide with heat-treated siliceous earth (Hyflo Super Cel) the columns were found to filter much more evenly and rapidly.

Carrot root carotene has been separated into its major constituents by means of magnesium oxide with a recovery of from 30 to 40 per cent. of the β-carotene and from 40 to 70 per cent. of the α-carotene originally present. The α-carotene prepared by this method was identical with α-carotene separated from carrot root carotene by other methods,[1] as determined by its melting point, optical rotation, solubility and absorption maxima in ethanol and carbon disulfide. The β-carotene also proved to be identical with that isolated from carrot root carotene and from leaf carotene,[2] as determined by similar physical properties.

α–Carotene
Melting point, 184° corrected.
Specific rotation, $[\alpha]^{20°}_{6678}$ +351° (benzene)
Absorption maxima, (Ångström units)

Ethanol	4457	4760
Benzene	4587	4881
Carbon disulfide	4764	5071

β–Carotene
Melting point, 178° corrected.
Specific rotation, $[\alpha]^{20°}_{6678}$ 0° (benzene)
Absorption maxima, (Ångström units)

Ethanol	4520	4818
Carbon disulfide	4850	5114

HAROLD H. STRAIN
CARNEGIE INSTITUTION OF WASHINGTON
STANFORD UNIVERSITY
DECEMBER 5, 1933

1 P. Karrer and O. Walker, *Helv. chim. Acta*, 16: 641, 1933.
2 R. Kuhn and E. Lederer, *Ber. deutsch. chem. Ges.*, 64: 1349, 1931.

BOOKS RECEIVED

BREWER, F. M. *Elementary Qualitative Analysis.* Pp. v + 228. Oxford University Press. $2.00.
BRIDGMAN, P. W. *The Thermodynamics of Electrical Phenomena in Metals.* Pp. vi + 200. 33 figures. Macmillan. $3.75.
CHOW, H. F. *The Familiar Trees of Hopei.* Pp. xii + 370. 143 figures. Peking Natural History Bulletin, China.
HUXLEY, JULIAN S. and G. R. DE BEER. *The Elements of Experimental Embryology.* Pp. xii + 514. 211 figures. Macmillan. $7.00.
MITCHELL, ALLAN C. G. and MARK W. ZEMANSKY. *Resonance Radiation and Excited Atoms.* Pp. xvi + 338. 84 figures. Macmillan. $5.00.
Papers Concerning the Palaeontology of California, Arizona and Idaho. Pp. 135. Illustrated. Carnegie Institution of Washington.
ROBINSON, W. W. *Ancient Animals.* Pp. xii + 96. Illustrated by Irene Robinson. Macmillan. $2.00.
TIETJENS, O. G. *Fundamentals of Hydro- and Aeromechanics.* Based on Lectures of L. Prandtl. Translated by L. Rosenhead. Pp. xvi + 270. 185 figures. *Applied Hydro- and Aeromechanics.* Based on Lectures of L. Prandtl. Translated by J. P. Den Hartog. Pp. xvi + 311. Illustrated. McGraw-Hill.
WHITEHEAD, T. N. *The Design of Instruments and Accurate Mechanism.* Pp. xii + 283. Macmillan. $3.50.